

INSC 484 Database Applications

COURSE INFORMATION

INSC 484, Fall 2022, 3 Credit Hours
University of Tennessee, Knoxville
Course Mode: On-campus, in-person;
Class Meetings: HBB-113, MWF, 3:00PM – 3:50PM, EST

Faculty Contact Information

- Dr. Ben Horne, Assistant Professor
- he/him/his
- bhorne6@utk.edu
- Office: 440B Communications Building
- Zoom: <https://tennessee.zoom.us/j/6473366886>
- Office Hours (Office or Zoom): By Appointment
- **Note: Class is in person, not on zoom!** Unless there are technical issues, lectures will be recorded if you miss class.

SIS Office Information

- 450 Communications Bldg.
- 1345 Circle Park Drive
- Knoxville, TN 37996-0341
- SIS Office: 865.974.2148
- Fax (SIS): 865.974.4667

Welcome Statement

Welcome to INSC 484! This class is a unique continuation of both INSC 384 and INSC 360. Specifically, our goal will be to build prototype client/server systems, where we design and apply database models on the server side and build modular systems that interact with the client (typically the user) and the server (the database management system). You will be using both the design skills learned in INSC 384 and the programming skills learned in INSC 360 to do this.

The class is setup is as follows: In the beginning of the class, we will review and strengthen both your Python skills and your Database design skills. In most of the class, we will focus on building client/server systems through several start to finished projects.

What constitutes an excused absence due to COVID-19?

Examples of the need to self-isolate include:

- Having tested positive for COVID-19
- Developing symptoms of a COVID-19 infection
- Awaiting COVID-19 test results
- Having had close contact with someone known to be diagnosed with COVID-19

- Having been advised to self-isolate by a health authority
- Having recently returned to the US after traveling abroad
- Having recently returned from a cruise (ocean or river)

What does it mean for an absence to be excused?

Scholars whose absence is excused may not receive an academic penalty for their absence and must be allowed to either make up any in-class assignment, quiz, or exam or to complete a substantially equivalent assignment, quiz, or exam.

When and how should scholars report they are self-isolating?

If a scholar's self-isolation or health condition could affect their ability to participate in classes, they should communicate directly with their instructors before the scheduled class time. Self isolating students should also complete the online self-isolation form.

Scholars are being asked to follow the guidance on the coronavirus website on when to self-isolate and what to do if they feel sick.

- When to self-isolate: <https://www.utk.edu/coronavirus/guides/when-to-self-isolate>
- What to do if you feel sick: <https://www.utk.edu/coronavirus/guides/what-to-do-if-you-feel-sick>

COURSE INFORMATION

Catalog Description

Applying database models to develop applications using a database management system. Developing prototype client/server applications. Advanced Structured Query Language (SQL).
 (RE) Prerequisite(s): INSC 360 and INSC 384.

Student Learning Outcomes

Students who complete this course will be capable of demonstrating awareness, knowledge, and/or understanding of:

- Database Management Systems, such as PostgreSQL.
- How database design impacts application implementation.
- Building client/server applications that interact with a database.
- High-level client/server systems architectures and design choices.

Required Text(s)

There is no required text at this time. However, there will be a few readings which I will provide on canvas. Optionally, I recommend *Database Systems: The Complete Book* by Garcia-Molina, Ullman, and Widom for the first third of the class. You may already have *Database Systems: Design, Implementation and Management* by Coronel, Carlos and Morris, Steven from INSC 384, which will also work for the first third of the class.

COMMUNICATION

Email

I am required to communicate with you through your UTK email address. If you prefer to use another address, consult the [OIT Helpdesk](#) to obtain directions for forwarding your UTK email to your preferred address if you do not wish to check both accounts.

Instructor Availability

Feel free to email me with any questions or concerns. I will typically respond in one to two business days.

COMPUTING REQUIREMENTS AND RESOURCES

Requirements

Bring your laptop to every class.

We will install several pieces of software throughout the semester. Each should require minimal computing power and work across operating systems.

For our IDE, we will use PyCharm. While I am okay with other IDEs, PyCharm has several features that will be helpful when moving across files, which we will do often in class.

More importantly, everything will be done in Python 3, not Python 2. Maybe we will have time to discuss the historical battle between Python 3 and Python 2, but at least know they are different enough to matter in your homework assignments and some of the things we do in class. I will point out what things are specific to Python 3 and what things are more general.

You must store your programs on some type of cloud storage (Google Drive, OneDrive, Dropbox, etc.)! There will not be time for “my dog ate my computer” like excuses. Please be organized in storing files.

Course Resources

Everything for class will be hosted on Canvas.

COURSE ATTENDANCE AND PARTICIPATION POLICIES

Learner Expectations

- Be prepared for all classes
- Be respectful of others
- Actively contribute to the learning activities in class
- Abide by the UT Honor Code Instructor Expectations

Instructor Expectations

- Be prepared for all classes
- Evaluate all work fairly and equitably
- Provide timely feedback
- Be respectful of all students

- Be responsive to student emails and requests for meetings
- Create and facilitate meaningful learning activities
- Behave according to University codes of conduct

Attendance and Participation

As described in the Assignments section, you are expected to attend class and participate.

Inclement Weather

The chancellor (or appointed representative) may officially close or suspend selected activities of the university because of extreme weather conditions. When a decision to close is made, it applies to all classes (whether on-campus or online). The information is distributed to the campus community, shared with local media, and posted on the University homepage at <http://utk.edu>.

ADDITIONAL POLICIES AND POINTS OF INFORMATION

Disability Services

The University of Tennessee, Knoxville, is committed to providing an inclusive learning environment for all students. If you anticipate or experience a barrier in this course due to a chronic health condition, a learning, hearing, neurological, mental health, vision, physical, or other kind of disability, or a temporary injury, you are encouraged to contact Student Disability Services (SDS) at 865-974-6087 or sds@utk.edu. An SDS Coordinator will meet with you to develop a plan to ensure you have equitable access to this course. If you are already registered with SDS, please contact your instructor to discuss implementing accommodations included in your course access letter.

University Civility Statement

Civility is genuine respect and regard for others: politeness, consideration, tact, good manners, graciousness, cordiality, affability, amiability and courteousness. Civility enhances academic freedom and integrity, and is a prerequisite to the free exchange of ideas and knowledge in the learning community. Our community consists of students, faculty, staff, alumni, and campus visitors. Community members affect each other's well-being and have a shared interest in creating and sustaining an environment where all community members and their points of view are valued and respected. Affirming the value of each member of the university community, the campus asks that all its members adhere to the principles of civility and community adopted by the campus. For more information, see the [UT Principles of Civility and Community](#).

CCI Diversity Statement

The College of Communication and Information recognizes that a college diverse in its people, curricula, scholarship, research, and creative activities expands opportunities for intellectual inquiry and engagement, helps students develop critical thinking skills, and prepares students for social and civic responsibilities. All members of the College benefit from diversity and the quality of learning, research, scholarship and creative activities is enhanced by a climate of inclusion, understanding and appreciation of differences and the full range of human experience. As a result, the College is committed to diversity and equal opportunity and it recognizes that it must represent the diversity inherent in American society. The College is acutely aware that diversity

and fairness are foundations that unite the College's faculty, staff, students, and the larger communication and information community.

Instructor Status as a Title IX Mandatory Reporter

University of Tennessee faculty are committed to supporting our students and upholding gender equity laws as outlined by Title IX. Please be aware that if you choose to confide in a faculty member regarding an issue of sexual misconduct, dating violence, or stalking, we are obligated to inform the University's Title IX Coordinator, who can assist you in connecting with all possible resources both on- and off-campus. If you would like to speak with someone confidentially, the Student Counseling Center (865-974-2196) and the Student Health Center (865-974-3135) are both confidential resources. For additional resources and information, visit titleix.utk.edu.

ASSIGNMENTS, ASSESSMENTS, AND EVALUATIONS

Academic Integrity

Students should be familiar with the [Hilltopics Student Handbook](#), and comply with all academic policies. This includes the University of Tennessee Honor Statement and the Academic Integrity Policy.

The Honor Statement reads: "*An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.*" For more information, see the Honor Statement on the Academic Policies and Procedures page of the current [catalog](#) for student and faculty responsibilities.

The Academic Integrity policy reads: "*Study, preparation and presentation should involve at all times the student's own work, unless it has been clearly specified that work is to be a team effort. Academic honesty requires that the student present his or her own work in all academic projects, including tests, papers, homework, and class presentation. When incorporating the work of other scholars and writers into a project, the student must accurately cite the source of that work.*" For additional information, see the [Student Code of Conduct](#).

Plagiarism

Plagiarism in any of its forms is intolerable, and attention to matters of documentation in all written work is expected and required. Inadvertence, alleged lack of understanding, or avowed ignorance of the various types of plagiarism are not acceptable excuses.

Specific examples of plagiarism are:

1. Copying without proper documentation (quotation marks and a citation) written or spoken words, phrases, or sentences from any source.
2. Summarizing without proper documentation (usually a citation) ideas from another source (unless such information is recognized as common knowledge).
3. Borrowing facts, statistics, graphs, pictorial representations, or phrases without acknowledging the source (unless such information is recognized as common knowledge).

4. Collaborating on a graded assignment without the instructor's approval.
5. Submitting work, either in whole or in part, created by a professional service and used without attribution (e.g., paper, speech, bibliography, or photograph).

Students who may be unsure of the nature of plagiarism should consult the instructor or a guide for writing research reports. Resources are available through the University Libraries, including a [Citing Sources](#) guide.

Infractions of academic integrity are penalized according to the severity of the infraction but may include a course grade of "F."

Cheating

Students attempting to cheat should consider that cheating not only violates the academic integrity rules of the university, but also prevents them from gaining knowledge that experts in their field have deemed important for their future coursework or future career, cheapens the reputation, value, and meaningfulness of a degree from the University of Tennessee Knoxville, and penalizes students in the class who do not cheat and perform their work honestly.

In this course, copying code from internet resources or other students is considered cheating.

Assignments

This table provides a brief summary of assignment by name, due date, point value and percentage of final grade. A brief description of each assignment follows the table.

Assignment	Point Value	Percentage of Final Grade	Due Date
Participation in class projects	35	7%	
Quizzes (6 @ 15 points)	90	18%	#1 – 09/02 #2 – 09/16 #3 – 10/12 #4 – 10/28 #5 – 11/11 #6 – 12/02
“Setup” Homeworks (4 @ 6.25 points)	25	5%	#0 – 08/26 #1 – 09/12 #2 – 09/30 #3 – 11/07
Homework (3 @ 100 points)	300	60%	#1 – 09/16 #2 – 10/14 #3 – 11/18
Final Exam (1 @ 50 points)	50	10%	TBD
TOTAL	500	100%	

Participation in class projects (7%)

For most of the course, we will be developing start to finish projects during class time. While I will be posting all code written in class, I expect you to participate through asking questions, taking notes, or coding along with me. In order to participate, you must attend class.

Quizzes (18%)

During some of our class meetings, we will have short in-class quizzes. The format of these 'quizzes' will vary, with some essay and some multiple-choice questions. The goal of the quizzes will be to reinforce concepts we have gone over in class. In other words: "do you recognize this tool in your programming toolbox?" **Quizzes cannot be made-up.**

Setup Homeworks (5%)

Setup Homeworks will be our way of ensuring class time is spent on the material rather than each person's installation of various tools. For each tool that needs to be installed, I will put instructions on installation on Canvas to follow. Once you have these tools installed, you will submit a screenshot showing the tool is installed properly (what is required in the screenshot may differ per tool). Overall, the software we will use in this class will have very easy setups. So, there should be no issues. However, of course please ask questions if you have any.

Homework (60%)

Homework assignments are designed to give you an opportunity to apply, and engage with, the material from different sections of the class. **These are not small coding projects, but instead large, complete coding projects.**

- You will complete three homework assignments. These homeworks will follow closely to the in-class projects.
- **Start working on the homework early!**
- You should work on each project on your own. Be sure you understand the techniques and concepts covered in each homework.
- **Do not copy something from Stackoverflow, Chegg or use libraries that we have not discussed in class. Remember, focus on learning, not the grade.**
- Follow the instructions for each homework carefully.
- Please upload a separate file for each problem. For some problems you will need to upload a Python file (.py), others you will just need to upload a text file (.txt). Please name your files: HWyProblemx_FirstInitialLastName, where y is the homework number and x is the problem number. Some homeworks will be full projects rather than individual problems, in which case you will just need to submit the completed project.

Final Exam (10%)

- Exam will be comprehensive.
- More details will be provided later in the semester.

Submitting Assignments, Late Assignments

Assignments should be submitted to the "assignments" area of Canvas and are due before class on the due date listed on the Syllabus, unless otherwise posted.

You will be given up until a week after the due date to turn in late work for homeworks. Within the first 24 hours of the deadline, you will not lose points. However, **each 24 hours that the assignment is late after the first 24, you will be deducted 15%** of the grade before its graded for quality. Once the assignment submission is closed on Canvas, no late work will be accepted. Do not email me with submissions. All assignments must be submitted on Canvas.

More precisely, here is the late grade formula if you earned 100% quality on the assignment:
 $1.0 - ((DL - 1)0.15)$, where DL is the number of days late, which can be fractional.

Example 1: If an assignment is due Friday at 1pm and you submit the assignment at 1pm Saturday, you will be graded out of 100%, just like if you submitted it on Friday at 1pm;

$$1.0 - \left(\left(\frac{24}{24} - 1 \right) 0.15 \right) = 1.0$$

Example 2: If an assignment is due Friday at 1pm and you submit the assignment at 8pm Saturday, you will be graded out of 95.63%,

$$1.0 - \left(\left(\frac{31}{24} - 1 \right) 0.15 \right) = 0.95635$$

Example 3: If an assignment is due Friday at 1pm and you submit the assignment at 1pm Sunday, you will be graded out of 85%,

$$1.0 - \left(\left(\frac{48}{24} - 1 \right) 0.15 \right) = 0.85$$

Grading Scale

Semester grades will be assigned according to the following scale:

A	93-100	Superior performance (4 quality points)
A-	90-92.99	Intermediate superior performance (3.7 quality points)
B+	88-89.99	Very good performance (3.3 quality points)
B	83-87.99	Good performance (3.0 quality points)
B-	80-82.99	Intermediate good performance (2.7 quality points)
C+	78-79.99	Fair performance (2.3 quality points)
C	73-77.99	Satisfactory performance (2.0 quality points)
C-	70-72.99	Unsatisfactory performance (1.7 quality points)
D+	68-69.99	Unsatisfactory performance (1.3 quality points)
D	63-67.99	Unsatisfactory performance (1.0 quality points)
D-	60-62.99	Unsatisfactory performance (0.7 quality points)
F	0-59.99	Failure performance (0.0 quality points)
S		Satisfactory; only assigned for C or better work when a course is taken on a S/NC grading basis. Carries no point value.
NC		No Credit; indicates failure to complete a course satisfactorily and is only assigned for C- or worse work when a course is taken on a S/NC grading basis. Carries no point value.
I		Under extraordinary circumstances and at the discretion of the instructor, the grade of I (Incomplete) may be awarded to students who have satisfactorily completed a substantial portion of the course but cannot complete the course for reasons beyond their control. An I grade carries no quality points. If the I grade is not removed within one

		calendar year or upon graduation, it shall be changed to an F and count as a failure in the computation of the grade point average.
W		Indicates student has officially withdrawn from the course or the university. Carries no point value.

Incompletes

Based on the adopted University of Tennessee-Knoxville policy, a grade of *I* (Incomplete) is reserved for emergencies that prevent the student from completing the course on time. Incompletes are granted only under "the most unusual of circumstances" and solely at the discretion of the instructor. Plan your semester's course of study carefully to ensure sufficient time to complete the required work. For students who simply "disappear" without contacting the instructor and without completing the required form, an "F" is submitted.

COURSE EVALUATION

You will be invited by email to evaluate the course at the end of the term via TNVoice. Please participate in this valuable process. I also invite your comments throughout the course and read all comments, suggestions, and recommendations.

DISCLAIMER

The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.

Parts of this course are inspired by Sibel Adali's CSCI 4380 course at RPI.

COURSE OUTLINE

Week	Date	Module	Topic	Class Activities
1	08/24	0	Course Overview	
--	08/26	1	Python Refresher and Advanced Techniques <ul style="list-style-type: none"> • Overview of PyCharm • User input • List, Tuples, Sets, and Dictionaries • Mutability • Set operations • Comprehensions • Deconstructing variables 	SHW0 Due: Install Python 3 and PyCharm
2	08/29	1	Python Refresher and Advanced Techniques <ul style="list-style-type: none"> • Functions, args and params • File Importing • Relative Imports • Errors • First-class functions • Decorators 	
--	08/31	2	Software Design <ul style="list-style-type: none"> • Process Models • Principles that Guide practice 	Reading: SEPA-Chp4
--	09/02	2	Software Design <ul style="list-style-type: none"> • Software Requirements • Requirements Modeling • UML 	Reading: DBTCB-Chp9 (9.1 through 9.3.1), SEPA-Chp6 Quiz 1 in class
3	09/05		No Class	
--	09/07	3	Database Design Refresher and Theory <ul style="list-style-type: none"> • Databases • DBMS • Relational Databases 	Reading: DBTCB-Chp1, DBTCB-Chp2 (2.1 through 2.2)
--	09/09	3	Database Design Refresher and Theory	Reading: DBTCB-Chp3 (3.1 through 3.2), DBTCB-Chp3

			<ul style="list-style-type: none"> • Relational Databases • Relational Algebra 	(3.3 through 3.4)
4	09/12	5	Project 1: <ul style="list-style-type: none"> • Overview • Creating Menu • Python Lists as in-memory database 	SHW1 Due: Install DB Browser
--	09/14	5	Project 1: <ul style="list-style-type: none"> • SQL DB Viewer • Create DB • SQLite3 and Python 	
--	09/16	5	Project 1: <ul style="list-style-type: none"> • SQL Injection • Review concepts learned 	Quiz 2 in class Homework 1 Due
5	09/19	5	Project 1: <ul style="list-style-type: none"> • SQL Operations versus Python 	
--	09/21	6	Project 2	
--	09/23	6	Project 2	
6	09/26	6	Project 2	
--	09/28	6	Project 2	
--	09/30	7	Introduction to PostgreSQL <ul style="list-style-type: none"> • SQLite3 vs. PostgreSQL • psycopg2 	SHW2 Due: Install psycopg2, make ElephantSQL account
7	10/03	7	Introduction to PostgreSQL <ul style="list-style-type: none"> • Migrating Project 2 • Environment Vars 	
--	10/05	8	Project 3 <ul style="list-style-type: none"> • Setup and Design • Returning Clause • Review of list comprehensions • Extract_values() from psycopg2 	
--	10/07		No Class	
8	10/10	8	Project 3 <ul style="list-style-type: none"> • Built-in SQL functions 	

			<ul style="list-style-type: none"> • RANDOM clause in an ORDER BY 	
--	10/12	8	Project 3 <ul style="list-style-type: none"> • GROUP BY review • JOIN review • Intro to Window Functions 	Quiz 3 in class
--	10/14	8	Asynchronous In-Depth Look at Window Functions in PostgreSQL (Material on Canvas)	Homework 2 Due
9	10/17	8	Project 3 <ul style="list-style-type: none"> • Window functions • Alternative to Window function query in Python 	
--	10/19	8	Project 3 <ul style="list-style-type: none"> • DISTINCT • HAVING 	
--	10/21	8	Project 3 <ul style="list-style-type: none"> • Virtual Tables • Adding type hinting to our app • Review of concepts 	
10	10/24	9	OOP Review and Mini Project	
--	10/26	9	OOP Review and Mini Project	
--	10/28	9	OOP Review and Mini Project	Quiz 4 in class
11	10/31	10	Project 3 Extended: Dates, Times, and Objects <ul style="list-style-type: none"> • Separating our database entities into objects • <code>__repr__</code> function • Classmethod decorators 	
--	11/02	10	Project 3 Extended: Dates, Times, and Objects <ul style="list-style-type: none"> • Separating our database entities into objects continued 	
--	11/04	10	Project 3 Extended: Dates, Times, and Objects	

			<ul style="list-style-type: none"> • Connection pooling • Building our own Context Managers 	
12	11/07	10	Project 3 Extended: Dates, Times, and Objects <ul style="list-style-type: none"> • Datetime module • Timezones • Save dates in PostgreSQL 	
--	11/09	11	Advanced Postgres and SQL <ul style="list-style-type: none"> • PostgreSQL functions and procedures 	
--	11/11	11	Advanced Postgres and SQL	Quiz 5 in class
13	11/14	12	Images: Application Side and Server Side <ul style="list-style-type: none"> • Matplotlib Review and Practice (Application Side) 	SHW3 Due: Install Matplotlib
--	11/16	12	Images: Application Side and Server Side <ul style="list-style-type: none"> • Adding plots to Project 3 (pie, bar) • Image exporting 	
--	11/18	12	Images: Application Side and Server Side <ul style="list-style-type: none"> • Storing images with filepaths • Storing images with BLOBs and bytea 	Homework 3 Due
14	11/21		Buffer Day	
--	11/23		No Class	
--	11/25		No Class	
15	11/28	13	Project 4: <ul style="list-style-type: none"> • Software design, database design • Connection Pool/New User Env setup 	

--	11/30	13	Project 4: <ul style="list-style-type: none"> • Add new card, basic functions • Image functions 	
--	12/02	13	Project 4: <ul style="list-style-type: none"> • Charting functions 	Quiz 6 in class
16	12/05	13	Project 4: <ul style="list-style-type: none"> • Market API simulation • Assert, Type, and ArgParse 	
--	12/07	14	Final review	
--			Final Exam: TBD	